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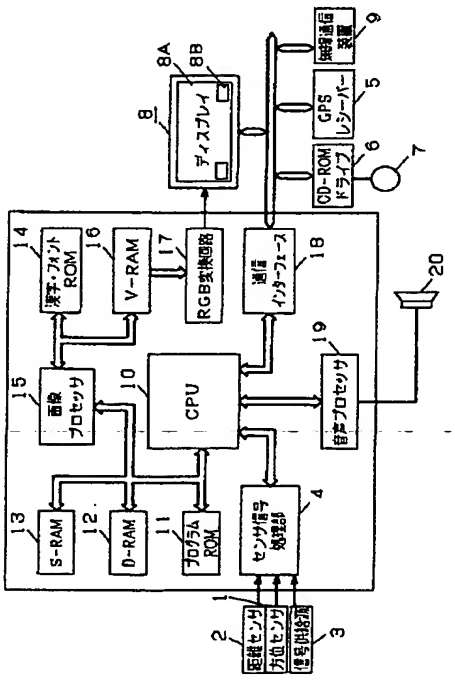
(54)【発明の名称】　移動通信装置

(57)【要約】

【課題】　目的地までの経路での、基地局との無線回線の接続を常に行って確実に通信を可能にする。

【解決手段】　道路データ及び基地局の位置情報とサービスエリア情報を記憶するＣＤ－ＲＯＭ７、基地局と通信する無線通信装置９、自車両の現在位置を検出するための方位センサ１、距離センサ２及びＧＰＳレシーバー５及び、ＣＰＵ１０を有する。操作スイッチ８Ｂから入力された目的地までの経路をＣＰＵ１０の処理で探索し、この探索された経路上で無線通信装置９と通信を行う基地局を変更するための基地局変更点を求める。検出した自車両の現在位置が、Ｓ－ＲＡＭ１３に記憶している基地局変更点に達した際に、無線通信装置９を通じて通信を行う基地局を自動的に変更して、常時通信が出来るようにする。



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【特許請求の範囲】

【請求項１】　少なくとも道路データ及び基地局の位置情報とサービスエリア情報を記憶した記憶手段と、前記基地局と通信する無線通信手段と、前記無線通信手段を搭載した自車両の現在位置を検出する現在位置検出手段と、目的地を入力する目的地入力手段と、前記目的地入力手段で入力された目的地までの経路を探索する経路探索手段と、前記経路探索手段で探索された経路上で前記無線通信手段と通信を行う前記基地局を変更するための基地局変更点を求める基地局変更点演算手段と、前記基地局変更点演算手段によって求められた基地局変更点のデータを記憶する基地局変更点記憶手段と、前記現在位置検出手段で検出した自車両の現在位置が、前記基地局変更点記憶手段に記憶している基地局変更点に達した際に、前記無線通信手段を通じて通信を行う基地局を変更する基地局変更手段とを備えることを特徴とする移動通信装置。

【請求項２】　前記記憶手段から読みだされた地図と、現在位置検出手段で検出した自車両の現在位置と、経路探索手段で検索される目的地までの経路とを画面表示する表示手段を備えることを特徴とする請求項１記載の移動通信装置。

【請求項３】　前記基地局から送信される基地局位置情報が記憶手段に記憶されているか否かを判定する判定手段と、前記判定手段で、記憶されていない新規の基地局と判定された際に自動的に記憶手段に、この新規基地局のデータを記憶することを特徴とする請求項１記載の移動通信装置。

【請求項４】　前記無線通信手段の通信可能エリアを優先して経路探索手段で経路探索を行うことを特徴とする請求項１記載の移動通信装置。

【請求項５】　通信可能な基地局を目的地として、経路探索手段で経路探索を行った、この探索経路を地図と共に表示手段で画面表示することを特徴とする請求項２記載の移動通信装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、セルラー方式の移動電話システムなどにあって、移動に伴い基地局切り換えを行う移動通信装置に関する。

【０００２】

【従来の技術】従来、セルラー方式の自動車電話システムなどでは、基地局のサービスエリア内で通話が可能であり、他のサービスエリアへ移動した場合、その移動した基地局に切り換えて、その無線通信回線を通じて通話を行うことになる。

【０００３】図１３は従来の自動車電話システムなどでの基地局の切り換え状態を説明するための図である。図１３（ａ）において、基地局Ａのサービスエリア３９Ａと基地局Ｂのサービスエリア３９Ｂにあって、移動局３８はサービスエリア３９Ａ内に位置しており、基地局Ａを通じて通信を行う。図１３（ｂ）において、移動局３８は基地局Ａのサービスエリア３９Ａから基地局Ｂのサービスエリア３９Ｂの方向に移動し、エリアが重なる基地局変更地点に位置している。最初にサービスエリア３９Ａの基地局Ａと通信を行っているが、基地局Ｂのサービスエリア３９Ｂと通信可能になると、基地局Ａに通信終了信号を送信し、基地局Ｂに通信開始信号を送信して、基地局Ａから基地局Ｂへの接続切り換えを行う。この後は図１３（ｃ）に示すように、移動局３９の基地局Ｂサービスエリア３９Ｂ内を移動中の際に、その基地局Ｂを通じて通信を行う。

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【０００４】このように、従来の移動通信装置でも、基地局Ａから、次の基地局Ｂに移動する際に、その接続を切り換えて通信を行うことが出来る。

【０００５】

【発明が解決しようとする課題】しかし、上記従来例の移動通信装置では、自動車電話機のように、高速で基地局のサービスエリアを移動すると、次の基地局との切り換え接続が間に合わず通信不能になることがあるという欠点があった。

【０００６】本発明は、このような従来の技術における課題を解決するものであり、目的地までの経路での、基地局との無線回線による接続が常に行われて、確実に通信が可能になる優れた移動通信装置を提供する。

【０００７】

【課題を解決するための手段】上記課題を達成するために、本発明の移動通信装置は、探索された経路上の基地局変更点が求められ、この探索経路上を自車両が走行し、かつ、基地局変更点を通過する際に、通信を行う基地局が自動的に変更できるようにしたものである。

【０００８】以上により、目的地までの経路での、基地局との無線回線による接続が常に行われて、確実に通信が可能になる移動通信装置を提供できる。

【０００９】

【発明の実施の形態】本発明の請求項１に記載の発明は、少なくとも道路データ及び基地局の位置情報とサービスエリア情報を記憶した記憶手段と、基地局と通信する無線通信手段と、無線通信手段を搭載した自車両の現在位置を検出する現在位置検出手段と、目的地を入力する目的地入力手段と、目的地入力手段で入力された目的地までの経路を探索する経路探索手段と、経路探索手段で探索された経路上で無線通信手段と通信を行う基地局を変更するための基地局変更点を求める基地局変更点演算手段と、基地局変更点演算手段によって求められた基地局変更点のデータを記憶する基地局変更点記憶手段と、現在位置検出手段で検出した自車両の現在位置が、基地局変更点記憶手段に記憶している基地局変更点に達した際に、無線通信手段を通じて通信を行う基地局を変更する基地局変更手段とを備えたものであり、探索され

た経路上の基地局変更点を求め、この探索経路上を自車両が走行し、かつ、基地局変更点を通過する際に、通信を行う基地局が自動的に変更することができるという作用を有する。

【００１０】また、請求項２に記載の発明は、前記記憶手段から読みだされた地図と、現在位置検出手段で検出した自車両の現在位置と、経路探索手段で検索される目的地までの経路とを、画面表示する表示手段を備えたものであり、常時基地局との通信が可能になると共に、表示される地図、自車両の現在位置及び目的地までの経路によって、目的地までの走行が確実かつ容易になるという作用を有する。

【００１１】また、請求項３に記載の発明は、前記基地局から送信される基地局位置情報が記憶手段に記憶されているか否かを判定する判定手段と、判定手段で、記憶されていない新規の基地局と判定された際に自動的に記憶手段に、この新規基地局のデータを記憶したものであり、記憶されていない新規の基地局のデータを自動的に記憶しているので、基地局変更点が確実に演算して得られるという作用を有する。

【００１２】また、請求項４に記載の発明は、通信可能エリアを優先して経路探索を行うものであり、確実に通信が行われるという作用を有する。

【００１３】また、請求項５に記載の発明は、通信可能な基地局を目的地として、経路探索手段で経路探索を行った、この探索経路を地図と共に表示手段で画面表示するものであり、通信可能エリア外の位置にいる場合に通信可能な基地局を目的地として探索した経路が表示されるという作用を有する。

【００１４】以下、本発明の実施形態を図面を参照して詳細に説明する。

（実施の形態１）図１は本発明の移動通信装置の実施形態の構成を示すブロック図である。図１において、自車両の方位を検出する方位センサ１と、自車両の車輪の回転数に応じたパルスを発生する距離センサ２と、図示しないブレーキスイッチ、パーキングスイッチなどのオン・オフ信号や電源電圧監視用信号などのセンサ信号を出力する信号供給源３とを有している。さらに、方位センサ１、距離センサ２及び信号供給源３からのセンサ信号を処理するセンサ信号処理部４と、複数のＧＰＳ(Global Positioning System)衛星からの電波を受信して自己絶対位置（緯度、経度）データを出力するＧＰＳレシーバー５と、地図データを送出するＣＤ－ＲＯＭドライブ６とが設けられている。また、ＣＤ－ＲＯＭドライブ６が読みだす地図データを予め格納したＣＤ－ＲＯＭ７と、車室内に配置される表示・操作部８と、基地局と通信を行うための無線通信装置９とを有している。さらに、表示・操作部８は、地図、自己走行位置及び方向等を画面表示する液晶ディスプレイ８Ａと、表示地図拡大又は縮小の指示スイッチ、経路探索を指示するスイッチなどからなる複数の操作スイッチ８Ｂとを有している。

【００１５】次に、本体装置は、各部の制御を行う中央演算処理装置（ＣＰＵ）１０と、ＣＰＵ１０が行う制御用のプログラムを予め記憶したＲＯＭ１１と、方位センサ１、距離センサ２、信号供給源３、ＧＰＳレシーバー５、ＣＤ－ＲＯＭドライブ６及び無線通信装置９からのデータやＣＰＵ１０の演算データを記憶するワーキング用のメモリ（Ｄ－ＲＡＭ）１２とを有している。また、電源供給停止時に必要なデータを記憶しておくバックアップ用のメモリ（Ｓ－ＲＡＭ）１３と、液晶ディスプレイ８Ａが表示する文字、記号などのパターンを予め記憶するメモリ（漢字・フォントＲＯＭ）１４とが設けられている。さらに、地図データや自己位置データに基づいて表示画像を形成するための画像プロセッサ１５と、この画像プロセッサ１５からの表示画像と漢字・フォントＲＯＭ１４からの町名、道路名などの漢字・フォントを合成して液晶ディスプレイ８Ａで表示する画像を記憶するメモリ（Ｖ－ＲＡＭ）１６とを有している。また、Ｖ－ＲＡＭ１６が出力するデータを色信号に変換して液晶ディスプレイ８Ａに出力するＲＧＢ変換回路１７と、ＧＰＳレシーバー５、ＣＤ－ＲＯＭドライブ６及び無線通信装置９とＣＰＵ１０とがデータをやり取りするための通信インタフェース１８とを有している。さらに、ＣＰＵ１０からのデータを所定の音声メッセージに生成して出力する音声プロセッサ１９と、この音声プロセッサ１９からの音声メッセージを出力するスピーカ２０とを有している。

【００１６】次に、この実施形態の動作について説明する。方位センサ１が方位を検出し、また、距離センサ２が自車両の車輪の回転数に応じたパルスを発生すると共に、信号供給源３から図示しないブレーキスイッチ、パーキングスイッチなどのオン・オフ信号や電源電圧監視用信号などのセンサ信号をセンサ信号処理部４に供給し、ここからＣＰＵ１０に出力される。また、ＧＰＳレシーバー５が複数のＧＰＳ衛星からの電波を受信して自己絶対位置（緯度、経度）データを通信インタフェース１８を通じてＣＰＵ１０に出力する。同様に、ＣＤ－ＲＯＭドライブ６がＣＤ－ＲＯＭ７から読みだした地図データと、無線通信装置９から、例えば、セルラー方式の移動電話システムにおける基地局と通信を行ったデータを通信インタフェース１８を通じてＣＰＵ１０に出力する。これらの操作が表示・操作部８の操作スイッチ８Ｂによって行われる。また、地図、自己走行位置及び方向等を液晶ディスプレイ８Ａで画面表示される。

【００１７】本体装置では、ＣＰＵ１０がＲＯＭ１１の制御用プログラムに従って、その演算を行い、また、方位センサ１、距離センサ２、信号供給源３、ＧＰＳレシーバー５、ＣＤ－ＲＯＭドライブ６及び無線通信装置９からのデータやＣＰＵ１０の演算データをＤ－ＲＡＭ１２に記憶し、また、電源供給停止時に必要なデータをＳ

ーＲＡＭ１３で記憶する。さらに、液晶ディスプレイ８Ａが表示する文字、記号などのパターンが漢字・フォントＲＯＭ１４からＣＰＵ１０の制御で読みだされると共に、画像プロセッサ１５が地図データや自己位置データに基づいて表示画像を形成する。画像プロセッサ１５からの表示画像と漢字・フォントＲＯＭ１４からの町名、道路名などの漢字・フォントを合成して液晶ディスプレイ８Ａで表示する画像をＶ－ＲＡＭ１６で記憶すると共に、このＶ－ＲＡＭ１６が出力するデータをＲＧＢ変換回路１７が色信号に変換して液晶ディスプレイ８Ａに出力する。さらに、ＣＰＵ１０からのデータを所定の音声メッセージに作成して音声プロセッサ１９がスピーカ２０に出力して、その音声出力を行う。

【００１８】図２はＣＤ－ＲＯＭ７に記憶されているデータフォーマットを示す図である。図２において、このデータフォーマットは、デイスクラベル２１と、描画パラメータ２２と、図葉管理情報２３と、図葉２４と、経路探索データ２５とを有している。図葉２４には、背景データ、文字データ、道路データなどが記憶されており、日本全国の地形図を緯度、経度によって分割した単位地図ごとのデータが記憶されている。図葉２４には、広い地域を粗く記述した図葉から狭い地域を詳細に記述した図葉が設定されている。各図葉を同一の地域を記述した地図表示レベルＡ，Ｂ，Ｃから構成されている。この地図表示レベルＡ～Ｃは、ＡはＢより詳細に記述され、また，ＢはＣより詳細に記述されている。また、各地図表示レベルＡ～Ｃは地図表示レベル管理情報と複数のユニットから構成されている。ユニットは各地図表示レベルの地域を複数に分割した地域を記述したものであり、各ユニットはユニットヘッド、文字レイヤ、背景レイヤ、道路レイヤ、基地局情報格納レイヤ、オプションレイヤなどから構成される。文字レイヤには、地図に表示される地名、道路名、施設名などが記録され、背景レイヤには道路、施設などを描画するためのデータが記憶＊されている。

【００１９】図３は道路レイヤを説明するための図である。図３に示すように、交差点を含む道路を記述する座標点（ノード）と線（リンク）に関するデータ、例えば、ノード番号、緯度、経度、リンク番号、リンク距離などが記憶されている。図３において、丸印（○）はノードを示し、このノード間の線はリンクを示している。また、ユニット２のノード番号４、ユニット１のノード番号３の黒丸（●）は交差点ノードを示している。なお、道路レイヤに記録されたデータは、地図表示に直接関与せず、マップマッチングのための道路網情報として使用されるものである。上記基地局情報格納エリアには、基地局の位置デヒタ（緯度、経度）、基地局のサービスエリア、基地局のＩＤ番号などが記憶されている。図２において、経路探索データ２５は、狭い地域を対象とした階層０から広い地域を対象とした階層ｎまでの各階層ごとに探索データが記録されている。各階層の探索データは、ノード接続データ２６、リンク想定通過支持間（リンクコスト）データ２７、経路表示データ２８から構成される。

【００２０】図４は経路探索方法を説明するための図である。図４において、ノード接続データ２６は各ノードａ～ｇ，ｘ，ｙが、どのノードと接続されているかを示すデータであり、例えば、ノードｃについてはノードａ，ｄ，ｆ，ｙに接続されていることを示すデータである。また、リンクコストデータ２７は図４に示すように各ノード間のリンクコストを示すものであり、例えば、ノードａとノードｃとの間のリンクコストは「５」であり、ノードａとノードｂとの間のリンクコストは「１０」、ノードａとノードｄとの間のリンクコストは「２０」であることを示している。上記リンクコストは次式（１）で求められる。

【００２１】

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$$\text{リンクコスト} = \text{リンク距離} / \text{設定時速} \quad \cdots (1)$$

図５はリンクコスト算出のための設定速度を示す図である。図５において、この設定速度は、例えば、道路種別と道路幅員に応じて設定されるものである。経路表示データ２８は探索経路によって選択された経路を表示地図上に表示するためのデータが記録されている。

【００２２】この経路探索動作について説明する。経路探索は図４に示すように、出発地（現在位置ノード）Ｘから目的地ノードＹに至る全ての経路のリンクコストを加算し、最もリンクコストが低い経路を選択するものである。図４の場合は、リンクＸ→ａ→ｃ→ｄ→ｆ→ｇ→ｙのリンクコスト合計（１０＋５＋５＋５＋５＋５＝３５）が最も小さくなるため、この経路が選択されるものである。

【００２３】この経路探索動作では、出発地、目的地の位置から最も近い出発ノード、目的、ノードを選択する。図４においては、ノードＸが出発ノードとして選択され、ノードＹが目的ノードに選択されたことを示している。次に、出発ノードＸを含む経路探索データをＣＤ－ＲＯＭ７から読み込み、出発地側の経路探索を行う。この経路探索は前記のように、リンクコスト合計が最も低くなる経路を選択するものである。次に、探索の結果、目的ノードに接続したか否かが判定される。出発地から目的地までの距離が比較的近く、ＣＤ－ＲＯＭ７から読み込んだデータ内に目的ノードＹが含まれている場合には、目的ノードに接続したと判定されるが、出発地から目的地が遠い場合に、目的ノードに接続しては判定されないため、目的ノードＹを含む経路探索データをＣＤ－ＲＯＭ７から読み込み目的地側の経路探索を行う。この目的地側の経路探索で選択された経路が出発地側の経路探索に接続されない場合には、探索階層を１ランク

上げる。

【００２４】図６は経路探索のための階層構造を説明するための図である。図６において、出発地側の経路探索で選択された経路が目的ノードと接続されず、また、目的地側の経路探索で選択された経路が出発地側の経路探索で探索された経路に接続されない場合には、階層１の経路探索２９が読み込まれ、出発ノード３０、目的ノード３１が設定される。階層１における経路探索により実線で示す経路が探索されると出発地から目的地までの経路を構成し、探索された経路の表示データを作成して経路探索を終了するものである。図３において、太い線は経路探索の結果で選択された案内経路を示しており、ユニット２のノード１→２→３→４→５→６→ユット１のノード１→２→３→６→７→８の経路が選択された案内経路であることを示している。案内経路が選択されると、交差点ノード（ユニット２のノード４及びユニット１のノード３）の手前のおよそ７００ｍ，３００ｍ，１００ｍに誘導ポイント（案内ポイント）Ａ１，Ｂ１，Ｃ１及びＡ２，Ｂ２，Ｃ２が設定される。自車両の走行に伴って、現在位置が誘導ポイントＡに達すると所定の音声案内、例えば、「およそ７００ｍで左方向です」と音声で案内する。同様に誘導ポイントＢ，Ｃに達すると、それぞれ「およそ３００ｍで左方向です」、「まもなく左方向です」と音声で案内する。

【００２５】図７は経路探索によって作成されるテーブルを示す図であり、図８は基地局の変更ポイント作成及び変更を行う処理を示す図である。図８において、まずステップＳ１で経路探索によって別経路追尾データテーブル（図７の（Ａ））を作成する。次のステップＳ２で別経路追尾データテーブルにより経路追尾データテーブル（図７の（Ｂ））を作成する。ステップＳ３では経路追尾データテーブルより通信基地変更点を求めるために各ノードを検索する。次のステップＳ４では経路追尾データテーブルに記録された各ノードに最も近い基地局を求める。ここでは各ノードの位置データ（緯度、経度）と、ＣＤ－ＲＯＭ７に記録されている基地局情報格納レイヤから読みだされた各基地局の位置データ（緯度、経度）からノードと基地局との距離の最も近い基地局を求める。次のステップＳ５で前ノードの最も近い基地局と現在のノードの最も近い基地局が一致するか否かを判定する。この判定は、例えば、図３中のユニット２のノード１で求めた最も近い基地局と、ユニット２のノード２で求めた最も近い基地局とが同一の基地局か否かを判定する。ここで前回のノードの最も近い基地局がない場合は、この前回のノードと現在求めたノードとの間に基地局の変更点があると判定し、基地局変更ポイントデータが作成される。例えば、図３にあって、ユニット２のノード１，２，３における最も近い基地局が同一の基地局Ｍ１であり、ユニット２のノード４における最も近い基地局が前記基地局Ｍ１と異なる基地局Ｍ２であった場

合、ユニット２のノード３とノード４との間に基地局変更点が存在することになり、ノード３とノード４との間に基地局変更点を設定する。すなわち、図７の（Ｄ）に示すように、基地局変更ポイントデータ（ａ）を記録するものである。この基地局変更ポイントデータ（ａ）は基地局変更点の位置データ（緯度、経度）、変更前の基地局のＩＤ番号、位置データ及び変更後の基地局のＩＤ番号、位置データなどである。同様にして基地局変更ポイントデータ（ｂ）（ｃ）（ｄ）（ｅ）が作成される。次の、ステップＳ５で、前回の基地局と現在求めている基地局とが一致しない場合はステップＳ６で基地局変更点を作成し、また、前回の基地局と現在求めている基地局とが一致する場合は基地局変更点を作成せずに、次のステップ７に進み、ここで基地局作成処理が経路追尾データテーブルの全てのノードに対して、この基地局ポイントデータ作成処理を終了すると、次に、自車両の走行によって前回算出した基地局変更ポイントデータを用いて基地局変更処理を行う。次に、ステップＳ８において、自車両が基地局変更点を通過したか否かを求める。ここで基地局を通過した場合は、ステップＳ９に進んで無線通信装置９へ基地局を変更するための情報を送信する。例えば、次の基地局の位置情報、ＩＤ番号等である。次に、ステップＳ１０へ進み、全ての基地局変更ポイントデータに対して基地局変更処理を行ったか否かを判定する。全てが終了していなければステップＳ８に戻る。この処理が基地局変更ポイントデータ分だけ処理すると終了となる。このように、案内経路上の基地局変更点を求めて、自車両の現在位置を知ることで無線通信装置９が随時、受信電波の受信電界強度と通信可能基地局を求めて行っていた基地局変更が、簡単に処理される。

【００２６】図９は増加する基地局を順次追加する処理手順を示すフロー図である。図９において、ステップＳ２１で無線通信装置９で受信した基地局から送信されるＩＤと位置情報が、記憶装置（ＣＤ－ＲＯＭ７又はＳ－ＲＡＭ１３）に記憶されているデータ内に存在するか否かを判定する。記憶装置（ＣＤ－ＲＯＭ７又はＳ－ＲＡＭ１３）に存在しない新規の基地局である場合にステップＳ２２に進んでＳ－ＲＡＭ１３に新規基地局として記憶する。すでに記憶装置に存在する基地の場合は、その処理を行わずに終了する。この結果、新規作成に伴い増加する基地局を順次追加でき、基地局変更点を確実に求めるための新たなデータ供給が行われる。

【００２７】図１０は通信可能エリアまで到達する際の処理を説明するための図であり、図１１は通信エリアまでの案内の表示画面を示す図である。図１０において、無線通信装置９（自車両）が基地局のサービスエリア外に移動した場合、サービスエリア外の現在位置から最も近い基地局を検索し、この基地局を目的地として経路探索を行い、最も近い基地局までの経路を液晶ディスプレイ８Ａ上の地図に表示する。図１１（ａ）において、斜

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線部分３５は、基地局と通信できるサービスエリアを示している。また、通信可能か否かを示す受話器マーク３６が点灯している際に、その通信が可能である。受話器マーク３６が点灯していないときは通信が不可能であることを示す。図１１（ｂ）に示すように自車両位置３４が通信可能エリアをはずれると図１０に示す処理を行う。この処理では、ステップＳ３１で基地局との通信が可能であるか否かを判定する。通信が不可能の場合は、ステップＳ３２でユーザーからの要求によって通信可能エリアまでの案内を行うか否かを判定する。ユーザーが通信可能エリアまでの案内を要求した際に、ステップＳ３３で図１１（ｃ）に示すように、表示画面上に可能エリアまでを探索する画面３７を表示して最も近い基地局までの経路探索処理を行う。このように、ユーザーが電話を行いたい場合に、表示画面の地図からは判明しない通信可能エリアまでの経路探索を記憶装置に記憶された基地局データを用いることで、迅速に通信可能エリアまで到達できるようになる。

【００２８】図１２は、目的地の設定時の液晶ディスプレイ８Ａにおける表示画面例を示す図である。図１２において、目的地３３ａ、経由地３３ｂ，３３ｃ、有料道路を通過する経路３３ｄを探索するか否かを入力し、かつ、無線通信装置９の通信可能エリア３３ｅを優先して経路探索を行うか否かを入力する。この目的地の設定時に通信可能エリアを優先する指定３４を行った場合には、通信可能エリア内にあるリンクコスト（例えば、図４に示すリンクコスト）から所定値を減算したリンクコストを使用する経路探索が実行される。

【００２９】この結果、車両が通行中は常に無線通信装置９を使用した場合に、少し遠回りになることもあるが、常に無線通信装置９が使用可能なルートを選ぶことが出来るようになる。

【００３０】

【発明の効果】以上の説明から明らかなように、本発明の移動通信装置は、探索された経路上の基地局変更点が求められ、この探索経路上を自車両が走行し、かつ、基地局変更点を通過する際に、通信を行う基地局が自動的に変更しているため、目的地までの経路での、基地局との無線回線での接続が常に行われて、確実に通信が可能になる。

【図面の簡単な説明】

【図１】本発明の実施形態における移動通信装置の構成を示すブロック図

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【図２】同実施形態の地図データフォーマットを示す構成図

【図３】同実施形態の道路レイヤの構成を示す構成図

【図４】同実施形態の経路探索方法を示す経路の構成を示す構成図

【図５】同実施形態のリンクコスト算出のための設定速度データの構成図

【図６】同実施形態の経路探索のための階層構造を示す模式図

【図７】同実施形態の経路探索によって作成されるテーブルを示す構成図

【図８】同実施形態の基地局の変更ポイント作成及び変更処理を示すフロー図

【図９】同実施形態の増加基地局を順次追加する処理手順を示すフロー図

【図１０】同実施形態の通信可能エリアまで到達する際の処理を示すフロー図

【図１１】同実施形態の通信エリアまでの案内の表示画面を示す表示図

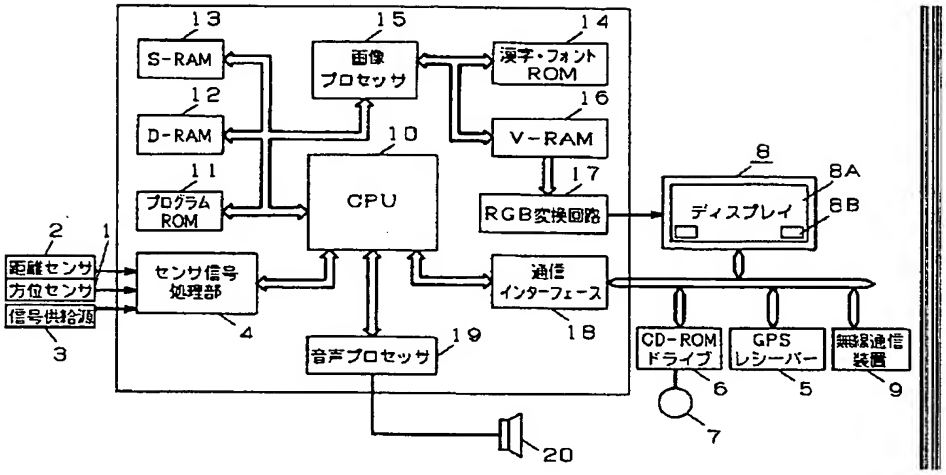
【図１２】同実施形態の目的地の設定時の表示画面例を示す表示図

【図１３】従来の自動車電話システムなどでの基地局の切り換え状態を示す模式図

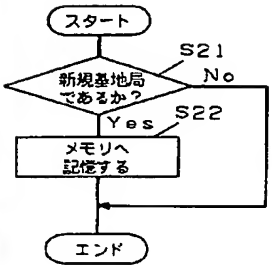
【符号の説明】

１　方位センサ
２　距離センサ
３　信号供給源
４　センサ信号処理部
５　ＧＰＳレシーバー
６　ＣＤ－ＲＯＭドライブ
７　ＣＤ－ＲＯＭ
８　表示・操作部
８Ａ　液晶ディスプレイ
８Ｂ　操作スイッチ
９　無線通信装置
１０　ＣＰＵ
１１　ＲＯＭ
１２　Ｄ－ＲＡＭ
１３　Ｓ－ＲＡＭ
１４　漢字・フォントＲＯＭ
１５　画像プロセッサ
１８　通信インタフェース

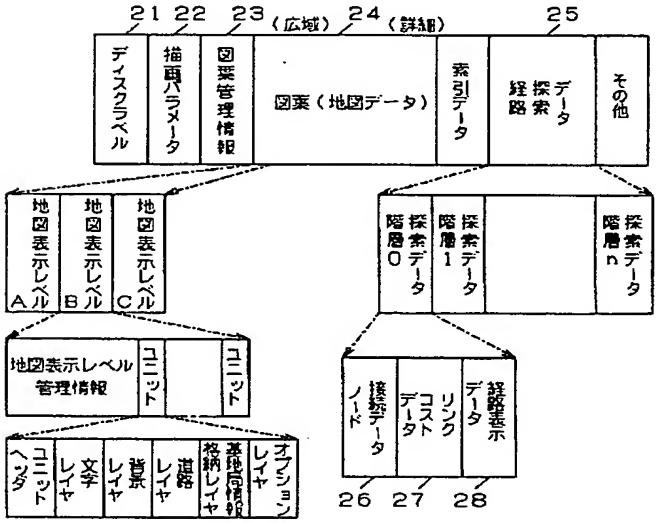
【図１】



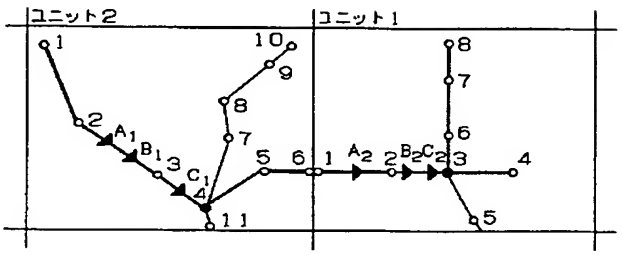
【図９】



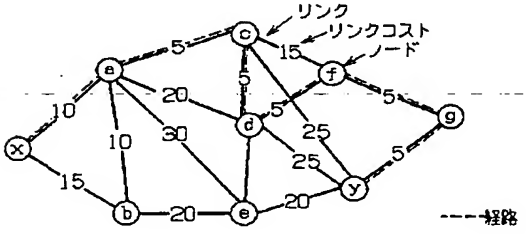
【図２】



【図３】



【図４】

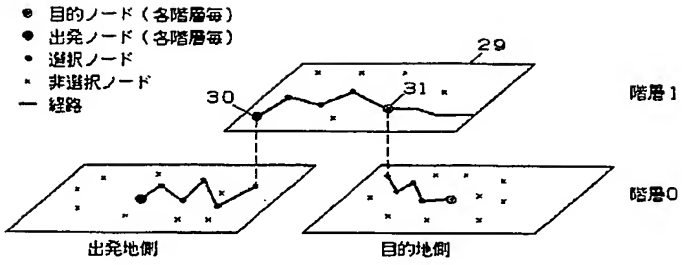


【図５】

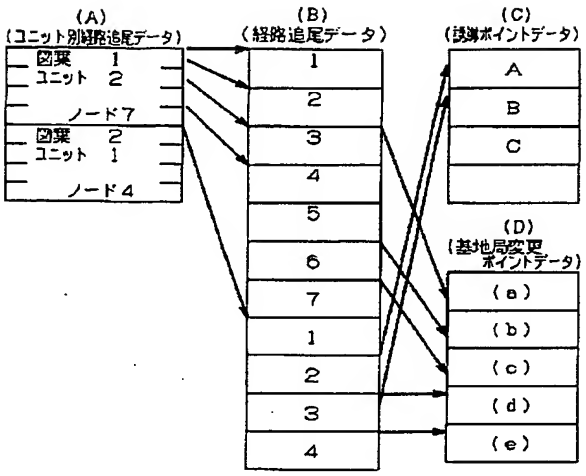
道路種別 / 道路幅員	高速	有料道	国道	主要地方道	その他
～13.0	60	40	40	30	20
13.0～25.0	80	60	60	60	50
25.0～50.0	100	70	60	60	50
50.0～75.0	100	80	60	60	50
75.0～	100	80	60	60	50

（単位km／h）

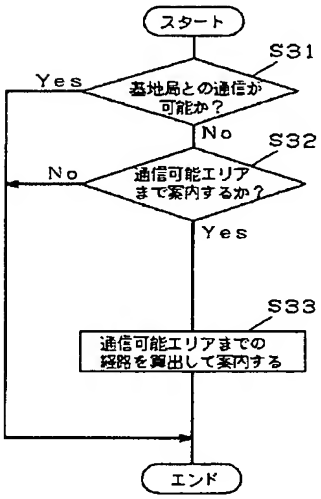
【図６】


目的ノード（各階層毎）
出発ノード（各階層毎）
選択ノード
非選択ノード
経路
29
30
31
階層１
階層０
出発地側
目的地側

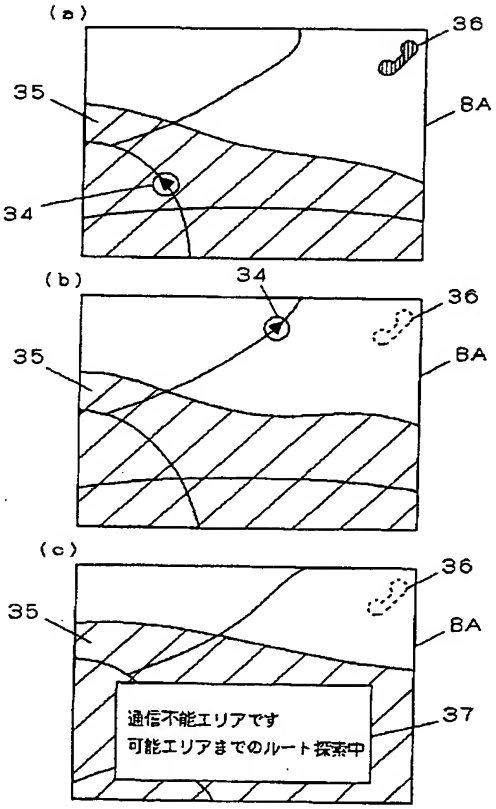
【図７】


(A)
(ユニット別経路追尾データ)
図葉 1
ユニット 2
ノード7
図葉 2
ユニット 1
ノード4
(B)
(経路追尾データ)
1
2
3
4
5
6
7
1
2
3
4
(C)
(誘導ポイントデータ)
A
B
C
(D)
(基地局変更ポイントデータ)
(a)
(b)
(c)
(d)
(e)

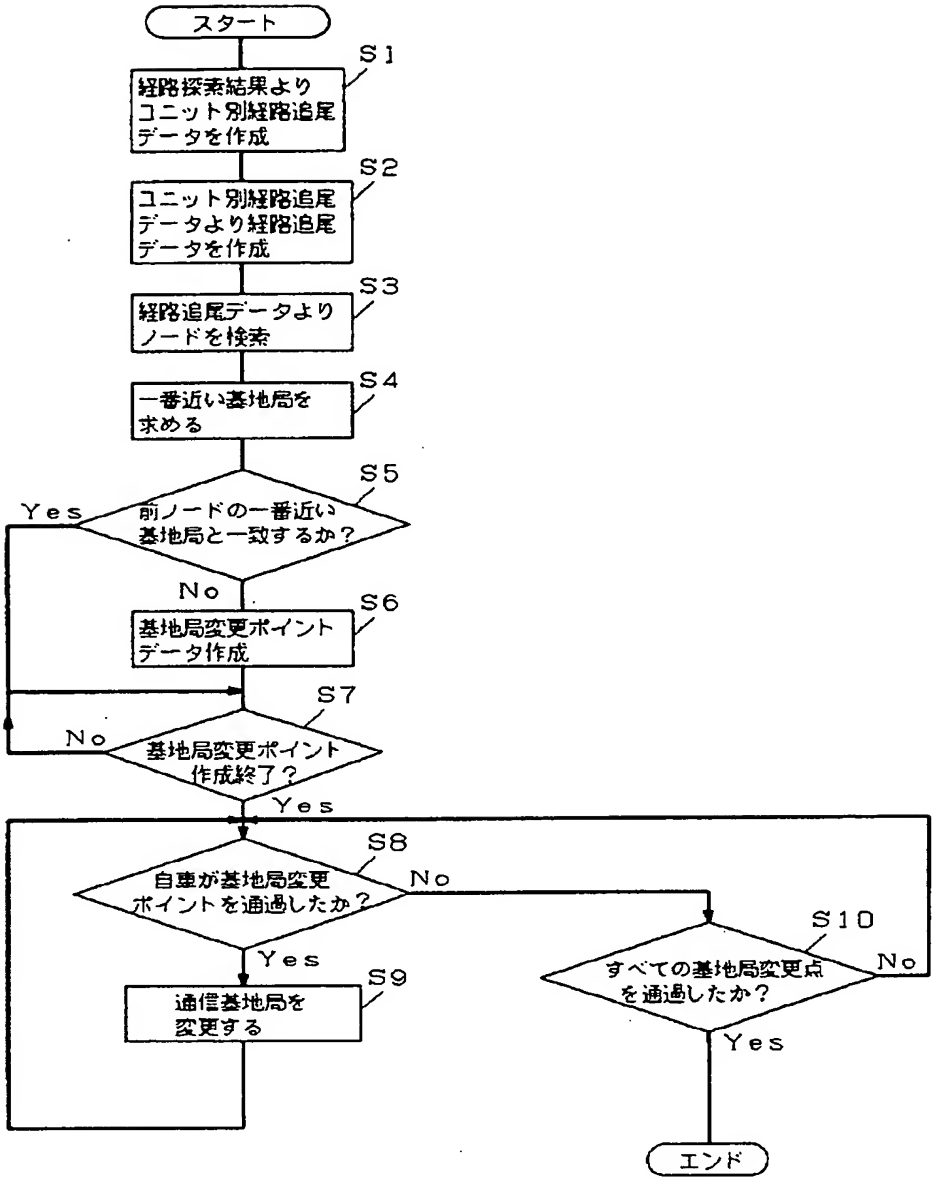
【図１０】


スタート
S31
Yes
基地局との通信が可能か？
No
S32
No
通信可能エリアまで案内するか？
Yes
S33
通信可能エリアまでの経路を算出して案内する
エンド

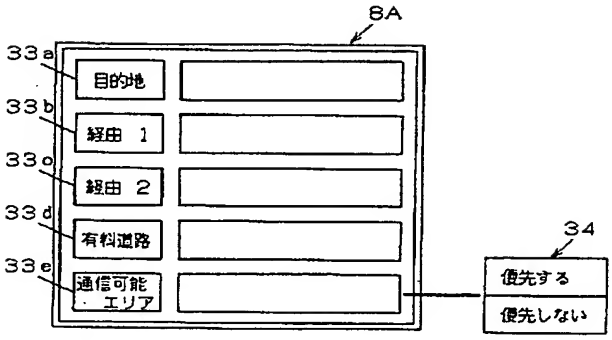
【図１１】


(a)
36
35
8A
34
(b)
34
36
35
8A
(c)
36
35
8A
通信不能エリアです
可能エリアまでのルート探索中
37

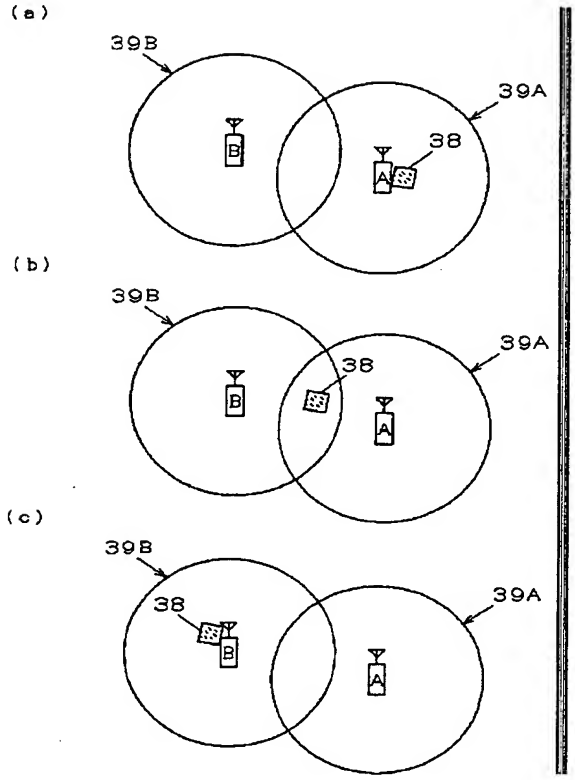
【図８】


スタート
S1
経路探索結果より
コニット別経路追尾
データを作成
S2
コニット別経路追尾
データより経路追尾
データを作成
S3
経路追尾データより
ノードを検索
S4
一番近い基地局を
求める
S5
前ノードの一番近い
基地局と一致するか？
Yes
No
S6
基地局変更ポイント
データ作成
S7
基地局変更ポイント
作成終了？
No
Yes
S8
自車が基地局変更
ポイントを通過したか？
No
Yes
S9
通信基地局を
変更する
S10
すべての基地局変更点
を通過したか？
No
Yes
エンド

【図１２】


8A
33a
目的地
33b
経由 1
33c
経由 2
33d
有料道路
33e
通信可能エリア
34
優先する
優先しない

【図１３】


(a)
39B
39A
38
B
A
(b)
39B
39A
38
B
A
(c)
39B
38
39A
B
A

PATENT ABSTRACTS OF JAPAN

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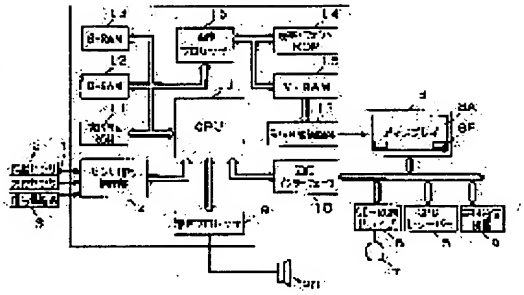
(72)Inventor : GOMI HIROYOSHI

(54) MOBILE COMMUNICATION EQUIPMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To enable communication exactly by performing the connection of radio line to a base station through the path to the destination at all times.

SOLUTION: This equipment has a CD-ROM 7 for storing road data, position information of base station and service area information, a radio communication equipment 9 for communicating with the base station, an azimuth sensor 1 for detecting the current position of present vehicle, a distance sensor 2, a GPS receiver 5 and a CPU 10. The route to the destination inputted from an operating switch 8B is searched by the processing of the CPU 10, and a base station change point for changing the base station to be communicated with the radio communication equipment 9 is found on this searched course. When the detected current position of present vehicle reaches the base station change point stored in an S-RAM 13, the base station to perform communication through the radio communication equipment 9 is automatically changed, so that communication can be performed at all times.



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CLAIMS

[Claim(s)]
[Claim 1] The storage means which memorized road data, and the positional information and service area information on a base station at least, A radio means to communicate with said base station, and a current position detection means to detect the current position of a self-car in which said radio means was carried, A destination input means to input the destination, and a path planning means to search for the path to the destination in which it was inputted with said destination input means, A base station changed part operation means to ask for the base station changed part for changing said base station which communicates with said radio means on the path for which it was searched with said path planning means, A base station changed part storage means to memorize the data of a base station changed part called for by said base station changed part operation means, The migration communication device characterized by having a base station modification means to change the base station which communicates through said radio means when the current position of the self-car detected with said current position detection means reaches the base station changed part memorized for said base station changed part storage means.
[Claim 2] The migration communication device according to claim 1 characterized by having the display means which carries out a screen display of the current position of the map read from said storage means, and the self-car detected with the current position detection means, and the path to the destination searched with a path planning means.
[Claim 3] The migration communication device according to claim 1 characterized by memorizing the data of this new base station for a storage means automatically [when judged with the new base station which is not memorized with a judgment means to judge whether the base station positional information transmitted from said base station is memorized by the storage means, and said judgment means].

[Claim 4] The migration communication device according to claim 1 characterized by giving priority to the area of said radio means which can be communicated, and performing path planning with a path planning means.
[Claim 5] The migration communication device according to claim 2 characterized by carrying out a screen display of this search path that performed path planning with the path planning means with a display means with a map by making into the

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destination the base station which can communicate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is in the mobile phone system of a cellular communication system etc., and relates to the migration communication device which performs a base station switch with migration.
[0002]
[Description of the Prior Art] Conventionally, in the land mobile radiotelephone system of a cellular communication system, when it can talk over the telephone in the service area of a base station and moves to other service areas, it will switch to the base station where it moved, and will talk over the telephone through the radio circuit.
[0003] Drawing 13 is drawing for explaining the switch condition of the base station in the conventional land mobile radiotelephone system etc. In drawing 13 (a), it is in service area 39A of a base station A, and service area 39B of a base station B, and the mobile station 38 is located in service area 39A, and communicates through a base station A. In drawing 13 (b), a mobile station 38 moves in the direction of service area 39B of a base station B from service area 39A of a base station A, and it is located in the base station modification point with which area laps. Although first communicated with the base station A of service area 39A, if service area 39B of a base station B and a communication link are attained, a communication link terminate signal will be transmitted to a base station A, a communication link start signal will be transmitted to a base station B, and the connection switch to a base station B will be performed from a base station A. After this, as shown in drawing 13 (c), in case the inside of base station B service area 39B of a mobile station 39 is under migration, it communicates through that base station B.
[0004] Thus, also with the conventional migration communication device, from a base station A, in case it moves to the next base station B, it can communicate by switching the connection.
[0005]
[Problem(s) to be Solved by the Invention] However, in the migration communication device of the above-mentioned conventional example, there was a fault that the switch connection with the next base station might not meet the deadline, but it might become communication link impossible like a land mobile

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radiotelephone machine if it moves in the service area of a base station at high speed.
[0006] The technical problem in such a Prior art is solved, connection by the wireless circuit with the base station in the path to the destination is always made, and this invention offers the outstanding migration communication device with which a communication link becomes possible certainly.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned technical problem, the base station which communicates enables it to change it automatically, in case the base station changed part on the path for which it was searched is called for, and a self-car runs this search-path top and the migration communication device of this invention passes a base station changed part.
[0008] Connection by the wireless circuit with the base station in the path to the destination is always made by the above, and the migration communication device with which a communication link becomes possible certainly can be offered.
[0009]
[Embodiment of the Invention] The storage means with which invention of this invention according to claim 1 memorized road data, and the positional information and service area information on a base station at least, A radio means to communicate with a base station, and a current position detection means to detect the current position of a self-car in which the radio means was carried, A destination input means to input the destination, and a path planning means to search for the path to the destination in which it was inputted with the destination input means, A base station changed part operation means to ask for the base station changed part for changing the base station which communicates with a radio means on the path for which it was searched with the path planning means, A base station changed part storage means to memorize the data of a base station changed part called for by the base station changed part operation means, When the current position of the self-car detected with the current position detection means reaches the base station changed part memorized for the base station changed part storage means It has a base station modification means to change the base station which communicates through a radio means. In case it asks for the base station changed part on the path for which it was searched, and a self-car runs this search-path top and a base station changed part is passed, it has an operation that the base station which communicates can change automatically.
[0010] Moreover, invention according to claim 2 has an operation that transit to the destination becomes certainly and easy, according to the path to the current position and the destination of the map displayed and a self-car while have the display means which carries out a screen display of the current position of the map read from said storage means, and the self-car detected with the current position detection means, and the path to the destination searched with a path-planning means and always being attained the communication link with a base station.
[0011] Moreover, invention according to claim 3 is a judgment means by which the base station positional information transmitted from said base station judges whether the storage means memorizes, and a judgment means. Since the data of this new base station were memorized for the storage means and the data of the

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new base station which is not memorized are automatically memorized when judged with the new base station which is not memorized, it has an operation that a base station changed part calculates certainly and is obtained.
[0012] Moreover, invention according to claim 4 has an operation that give priority to the area which can be communicated, perform path planning, and a communication link is ensured.
[0013] Moreover, invention according to claim 5 carries out a screen display of this search path that performed path planning with the path planning means with a display means with a map by making into the destination the base station which can communicate, and has an operation that the path which searched as a destination the base station which can communicate when it is in the location outside [which can be communicated] area is displayed.
[0014] Hereafter, the operation gestalt of this invention is explained to a detail with reference to a drawing.
(Gestalt 1 of operation) Drawing 1 is the block diagram showing the configuration of the operation gestalt of the migration communication device of this invention. In drawing 1 , it has the bearing sensor 1 which detects bearing of a self-car, the distance robot 2 which generates the pulse according to the engine speed of the wheel of a self-car, and the signal source of supply 3 which outputs sensor signals, such as on-off signals which are not illustrated, such as a brake switch and a parking switch, and a signal for a supply voltage monitor. Furthermore, the sensor signal-processing section 4 which processes the sensor signal from the bearing sensor 1, a distance robot 2, and the signal source of supply 3 and two or more GPS (Global Positioning System) The GPS receiver 5 which receives the electric wave from a satellite and outputs self-absolute location (LAT, LONG) data, and CD-ROM drive 6 which sends out map data are formed. Moreover, it has CD-ROM7 which stored beforehand the map data which CD-ROM drive 6 reads, the display and control unit 8 which are arranged in the vehicle interior of a room, and the radio communication equipment 9 for communicating with a base station. Furthermore, the display and the control unit 8 have two or more actuation switch 8B set to liquid crystal display 8A which carries out a screen display of a map, a self-transit location, the direction, etc. from display map expansion or the directions switch of contraction, the switch that directs path planning.
[0015] Next, the main frame has the memory 12 for working (D-RAM) which memorizes the arithmetic and program control (CPU) 10 which controls each part, ROM11 which memorized beforehand the program for control which CPU10 performs, the bearing sensor 1 and a distance robot 2, the signal source of supply 3, the GPS receiver 5, CD-ROM drive 6 and the data from a radio communication equipment 9, and the operation data of CPU10. Moreover, the memory (S-RAM) 13 for backup which memorizes data required at the time of a current supply halt, and the memory (kanji font ROM) 14 which memorizes beforehand patterns which liquid crystal display 8A displays, such as an alphabetic character and a notation, are formed. Furthermore, it has the memory (V-RAM) 16 which memorizes the image which compounds kanji fonts, such as a name of a town from the display image and kanji font ROM14 from the image processor 15 and this image processor 15 for forming a display image based on map data or self-location data,

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and a road name, and is displayed by liquid crystal display 8A. Moreover, it has the communication interface 18 for the RGB conversion circuit 17 which changes into a chrominance signal the data which V-RAM16 outputs, and is outputted to liquid crystal display 8A, and the GPS receiver 5, CD-ROM drive 6 and a radio communication equipment 9 and CPU10 to exchange data. Furthermore, it has the voice processor 19 which generates and outputs the data from CPU10 to a predetermined voice-told message, and the loudspeaker 20 which outputs the voice-told message from this voice processor 19.

[0016] Next, actuation of this operation gestalt is explained. Bearing is detected, and a distance robot 2 supplies sensor signals, such as on-off signals which are not illustrated from the signal source of supply 3 while generating the pulse according to the engine speed of the wheel of a self-car, such as a brake switch and a parking switch, and a signal for a supply voltage monitor, to the sensor signal-processing section 4, and the bearing sensor 1 is outputted to CPU10 from here. Moreover, the GPS receiver 5 receives the electric wave from two or more GPS Satellites, and outputs self-absolute location (LAT, LONG) data to CPU10 through a communication interface 18. Similarly, CD-ROM drive 6 outputs the data which communicated with the base station in the mobile phone system of a cellular communication system to CPU10 through a communication interface 18, for example from the map data read from CD-ROM7, and a radio communication equipment 9. These actuation is performed by actuation switch 8B of a display and a control unit 8. Moreover, a screen display of a map, a self-transit location, the direction, etc. is carried out by liquid crystal display 8A.

[0017] In the main frame, CPU10 performs the operation according to the program for control of ROM11, the bearing sensor 1, a distance robot 2, the signal source of supply 3, the GPS receiver 5, CD-ROM drive 6 and the data from a radio communication equipment 9, and the operation data of CPU10 are memorized to D-RAM12, and data required at the time of a current supply halt are memorized by S-RAM13. Furthermore, while patterns which liquid crystal display 8A displays, such as an alphabetic character and a notation, are read from kanji font ROM14 by control of CPU10, the image processor 15 forms a display image based on map data or self-location data. While memorizing the image which compounds kanji fonts, such as a name of a town from the display image and kanji font ROM14 from the image processor 15, and a road name, and is displayed by liquid crystal display 8A by V-RAM16, the RGB conversion circuit 17 changes into a chrominance signal the data which this V-RAM16 outputs, and outputs them to liquid crystal display 8A. Furthermore, the data from CPU10 are created to a predetermined voice-told message, and the voice processor 19 outputs to a loudspeaker 20, and performs the voice output.

[0018] Drawing 2 is drawing showing the data format memorized by CD-ROM7. In drawing 2 , this data format has De Dis Clavel 21, the drawing parameter 22, the map leaf management information 23, a map leaf 24, and the path planning data 25. Background data, alphabetic data, road data, etc. are memorized by the map leaf 24, and the data for every unit map which divided the topographical map of the Japan whole country by the LAT and LONG are memorized. The map leaf which described the narrow area in the detail is set to the map leaf 24 from the map leaf

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which described the large area coarsely. Each map leaf consists of map display level A, B, and C which described the same area. A is described for this map display level A-C by the detail from B, and B is described by the detail from C. Moreover, every place Fig. display level A-C consists of map display level management information and two or more units. A unit describes the area which divided the area of every place Fig. display level into plurality, and each unit consists of a unit head, an alphabetic character layer, a background layer, a road layer, a base station information storing layer, an option layer, etc. The name of a place displayed on a map, a road name, a facility name, etc. are recorded on an alphabetic character layer, and the data for drawing a road, a facility, etc. are memorized by the background layer.

[0019] Drawing 3 is drawing for explaining a road layer. As shown in drawing 3 , the data about the coordinate point (node) and line (link) which describe a road including a crossing, for example, a node number, the LAT, LONG, a link number, link distance, etc. are memorized. In drawing 3 , a round mark (O) shows a node and the line between this node shows the link. Moreover, the black dot (-) of the node number 4 of a unit 2 and the node number 3 of a unit 1 shows the crossing node. In addition, the data recorded on the road layer do not participate in a map display directly, but are used as road-system information for map matching. In the above-mentioned base station information storage area, location DEHITA (LAT, LONG) of a base station, the service area of a base station, the ID number of a base station, etc. are memorized. In drawing 2 , retrieval data are recorded for each [from the hierarchy 0 for the area where the path planning data 25 are narrow to the hierarchy n for a large area] hierarchy of every. Each hierarchy's retrieval data consist of data 27 and a path indicative data 28 between the node connection data 26 and link assumption passage support (link cost).

[0020] Drawing 4 is drawing for explaining the path planning approach. In drawing 4 , the node connection data 26 are data which each node a-g, x, and y are data in which it is shown with which node it connects, for example, show connecting with Nodes a, d, f, and y about Node c. Moreover, the link cost data 27 show the link cost between each node, as shown in drawing 4 , the link cost between Node a and Node c is "5", for example, as for the link cost between Node a and Node b, "10" and the link cost between Node a and Node d show that it is "20." The above-mentioned link cost is called for by the degree type (1).

[0021]

Link cost = link distance / setting speed -- (1)

Drawing 5 is drawing showing the setting rate for link cost calculation. In drawing 5 , this setting rate is set up according to for example, road classification and the width of street. Data for the path indicative data 28 to display the path chosen by the search path on a display map are recorded.

[0022] This path planning actuation is explained. As shown in drawing 4 , path planning adds the link cost of all paths from Origin (current position node) X to the destination node Y, and chooses the path in which link cost is the lowest. In the case of drawing 4 , since the link cost sum total (10+5+5+5+5+5=35) of link X->a->c->d->f->g->y becomes the smallest, this path is chosen.

[0023] The nearest start node, the purpose, and a node are chosen from the

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location of an origin and the destination in this path planning actuation. In drawing 4 , it is shown that Node X was chosen as a start node and Node Y was chosen as the purpose node. Next, the path planning data containing the start node X are read from CD-ROM7, and the path planning by the side of an origin is performed. This path planning chooses the path to which the link cost sum total becomes the lowest as mentioned above. Next, it is judged as a result of retrieval whether it connected with the purpose node. When the purpose node Y is contained in the data which the distance from an origin to the destination read from near and CD-ROM7 comparatively, it is judged with having connected with the purpose node, but since it is not judged if it connects with the purpose node when the destination is far from an origin, the path planning data containing the purpose node Y are read from CD-ROM7, and the path planning by the side of the destination is performed. When the path chosen by the path planning by the side of this destination is not connected to the path planning by the side of an origin, one rank of retrieval hierarchies is raised.

[0024] Drawing 6 is drawing for explaining the layered structure for path planning. In drawing 6 , when the path which the path chosen by the path planning by the side of an origin was not connected with the purpose node, and was chosen by the path planning by the side of the destination is not connected to the path for which the path planning by the side of an origin was searched, a hierarchy's 1 path planning 29 is read and the start node 30 and the purpose node 31 are set up. If searched for the path shown as a continuous line by the path planning in a hierarchy 1, the path from an origin to the destination will be constituted, the indicative data of the path for which it was searched will be created, and path planning will be ended. In drawing 3 , the thick line shows the guidance path chosen by the result of path planning, and it is shown that it is the guidance path as which the path of the node 1->2->3->6->7->8 of node 1 ->2 ->3 ->4 ->5 ->6 -> YUTTO 1 of a unit 2 was chosen. Selection of a guidance path sets the induction points (guidance point) A1, B1, C1, and A2, B-2, and C2 as about 700m before a crossing node (the node 4 of a unit 2, and node 3 of a unit 1), and 300m and 100m. if the current position reaches the induction point A with transit of a self-car -- predetermined voice guidance -- for example, it shows around with voice, saying "it is the left in about 700m." If the induction points B and C are reached similarly, it will show around with voice, respectively, saying "it is the left in about 300m", and "it being the left soon."

[0025] Drawing 7 is drawing showing the table created by path planning, and drawing 8 is drawing showing the processing which makes modification point creation and modification of a base station. In drawing 8 , an alternative pathway tailing data table ((A) of drawing 7) is first created by path planning at step S1. A path tailing data table ((B) of drawing 7) is created with an alternative pathway tailing data table at the following step S2. Each node is searched with step S3 in order to ask for a communication link base changed part from a path tailing data table. It asks for the base station nearest to each node recorded on the path tailing data table in the following step S4. Here, it asks for the nearest base station of the distance of a node and a base station from the location data (LAT, LONG) of each node, and the location data (LAT, LONG) of each base station read

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from the base station information storing layer currently recorded on CD-ROM7. It judges whether the nearest base station of a front node and the nearest base station of a current node are in agreement at the following step S5. This judgment judges whether it is the base station where the nearest base station for which it asked by the node 1 of the unit 2 in drawing 3 and the nearest base station for which it asked by the node 2 of a unit 2 are the same. When there is no nearest base station of the here last node, it judges with the changed part of a base station being between this last node and the node for which it asked now, and base station modification point data are created. For example, it is shown in drawing 3 , and when the nearest base station in the nodes 1, 2, and 3 of a unit 2 is the same base station M1 and the nearest base stations in the node 4 of a unit 2 are said base station M1 and a different base station M2, a base station changed part will exist between the node 3 of a unit 2, and a node 4, and a base station changed part is set up between a node 3 and a node 4. That is, as shown in (D) of drawing 7 , base station modification point data (a) are recorded. This base station modification point data (a) is the location data (LAT, LONG) of a base station changed part, the ID number of the base station before modification, location data and the ID number of the base station after modification, location data, etc. Base station modification point data (b), (c), (d), and (e) are created similarly. When the last base station and the base station for which it is asking now are not in agreement at the following step S5, a base station changed part is created at step S6. Moreover, when the last base station and the base station for which it is asking now are in agreement, progress to the following step 7, without creating a base station changed part, and base station creation processing receives all the nodes of a path tailing data table here. Termination of this base station point data origination processing performs [next] base station modification processing using the base station modification point data computed last time by transit of a self-car. Next, it asks for whether the self-car passed the base station changed part in step S8. When it passes through a base station here, the information for progressing to step S9 and changing a base station into a radio communication equipment 9 is transmitted. For example, they are the positional information of the next base station, an ID number, etc. Next, it progresses to step S10 and judges whether base station modification processing was performed to all base station modification point data. If all are not completed, it returns to step S8. If this processing processes by base station modification point data, it will be that it is ended. Thus, it asks for the base station changed part on a guidance path, and base station modification which the radio communication equipment 9 was making at any time in quest of the received field strength and the base station which can be communicated of a received electric wave by getting to know the current position of a self-car is processed simply.

[0026] Drawing 9 is the flow Fig. showing the procedure which carries out the sequential addition of the increasing base station. In drawing 9 , it judges whether ID transmitted from the base station received with the radio communication equipment 9 at step S21 and positional information exist in the data memorized by the store (CD-ROM7 or S-RAM13). When it is the new base station which does not exist in storage (CD-ROM7 or S-RAM13), it progresses to step S22 and

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memorizes as a new base station to S-RAM13. In the case of the base which already exists in storage, it ends, without performing the processing. Consequently, the sequential addition of the base station which increases with new creation can be carried out, and new data supply for asking for a base station changed part certainly is performed.

[0027] Drawing 10 is drawing for explaining the processing at the time of reaching to the area which can be communicated, and drawing 11 is drawing showing the display screen of guidance to a communications area. In drawing 10 , when a radio communication equipment 9 (self-car) moves out of the service area of a base station, the nearest base station is searched from the current position outside a service area, path planning is performed by making this base station into the destination, and the path to the nearest base station is displayed on the map on liquid crystal display 8A. In drawing 11 (a), the shadow area 35 shows the service area which can communicate with a base station. Moreover, when the earphone mark 36 which shows whether it can communicate or not is on, the communication link is possible. It is shown that it cannot communicate when the earphone mark 36 is not on. If the self-car location 34 separates from the area which can be communicated as shown in drawing 11 (b), processing shown in drawing 10 will be performed. By this processing, it judges whether the communication link with a base station is possible at step S31. When it cannot communicate, it judges whether the demand from a user performs guidance to the area which can be communicated at step S32. When a user demands guidance to the area which can be communicated, as step S33 shows to drawing 11 (c), Screen 37 searched even for possible area is displayed on the display screen, and path planning processing to the nearest base station is performed. Thus, when a user wants to telephone, from the map of the display screen, it can reach quickly to the area which can be communicated by using the base station data memorized by the store in the path planning to the area which does not become clear, and which can be communicated.

[0028] Drawing 12 is drawing showing the example of the display screen in liquid crystal display 8A at the time of a setup of the destination. In drawing 12 , it inputs whether it searches for 33d of paths which pass through destination 33a, the course grounds 33b and 33c, and a turnpike, and inputs whether priority is given to area 33e of a radio communication equipment 9 which can be communicated, and path planning is performed. When assignment 34 which gives priority to the area which can be communicated at the time of a setup of this destination is performed, the path planning which uses the link cost which subtracted the predetermined value from the link cost (for example, link cost shown in drawing 4) in [which can be communicated] area is performed.

[0029] Consequently, although it may be taking a long circuit for a while when a radio communication equipment 9 is always used while the car passed, the root where a radio communication equipment 9 is always usable can be chosen.

[0030]

[Effect of the Invention] Since the base station which communicates has changed the migration communication device of this invention automatically in case the base station changed part on the path for which it was searched is called for, and

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a self-car runs this search-path top and it passes a base station changed part, connection by the wireless circuit with the base station in the path to the destination is always made, and a communication link becomes possible certainly, so that clearly from the above explanation.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention is in the mobile phone system of a cellular communication system etc., and relates to the migration communication device which performs a base station switch with migration.

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PRIOR ART

[Description of the Prior Art] Conventionally, in the land mobile radiotelephone system of a cellular communication system, when it can talk over the telephone in the service area of a base station and moves to other service areas, it will switch to the base station where it moved, and will talk over the telephone through the radio circuit.
[0003] Drawing 13 is drawing for explaining the switch condition of the base station in the conventional land mobile radiotelephone system etc. In drawing 13 (a), it is in service area 39A of a base station A, and service area 39B of a base station B, and the mobile station 38 is located in service area 39A, and communicates through a base station A. In drawing 13 (b), a mobile station 38 moves in the direction of service area 39B of a base station B from service area 39A of a base station A, and it is located in the base station modification point with which area laps. Although first communicated with the base station A of service area 39A, if service area 39B of a base station B and a communication link are attained, a communication link terminate signal will be transmitted to a base station A, a communication link start signal will be transmitted to a base station B, and the connection switch to a base station B will be performed from a base station A. After this, as shown in drawing 13 (c), in case the inside of base station B service area 39B of a mobile station 39 is under migration, it communicates through that base station B.
[0004] Thus, also with the conventional migration communication device, from a base station A, in case it moves to the next base station B, it can communicate by switching the connection.

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EFFECT OF THE INVENTION

[Effect of the Invention] Since the base station which communicates has changed the migration communication device of this invention automatically in case the base station changed part on the path for which it was searched is called for, and a self-car runs this search-path top and it passes a base station changed part, connection by the wireless circuit with the base station in the path to the destination is always made, and a communication link becomes possible certainly, so that clearly from the above explanation.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the migration communication device of the above-mentioned conventional example, there was a fault that the switch connection with the next base station might not meet the deadline, but it might become communication link impossible like a land mobile radiotelephone machine if it moves in the service area of a base station at high speed.
[0006] The technical problem in such a Prior art is solved, connection by the wireless circuit with the base station in the path to the destination is always made, and this invention offers the outstanding migration communication device with which a communication link becomes possible certainly.

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned technical problem, the base station which communicates enables it to change it automatically, in case the base station changed part on the path for which it was searched is called for, and a self-car runs this search-path top and the migration communication device of this invention passes a base station changed part.
[0008] Connection by the wireless circuit with the base station in the path to the destination is always made by the above, and the migration communication device with which a communication link becomes possible certainly can be offered.
[0009]
[Embodiment of the Invention] The storage means with which invention of this invention according to claim 1 memorized road data, and the positional information and service area information on a base station at least, A radio means to communicate with a base station, and a current position detection means to detect the current position of a self-car in which the radio means was carried, A destination input means to input the destination, and a path planning means to search for the path to the destination in which it was inputted with the destination input means, A base station changed part operation means to ask for the base station changed part for changing the base station which communicates with a radio means on the path for which it was searched with the path planning means, A base station changed part storage means to memorize the data of a base station changed part called for by the base station changed part operation means, When the current position of the self-car detected with the current position detection means reaches the base station changed part memorized for the base station changed part storage means It has a base station modification means to change the base station which communicates through a radio means. In case it asks for the base station changed part on the path for which it was searched, and a self-car runs this search-path top and a base station changed part is passed, it has an operation that the base station which communicates can change automatically.
[0010] Moreover, invention according to claim 2 has an operation that transit to the destination becomes certainly and easy, according to the path to the current position and the destination of the map displayed and a self-car while have the display means which carries out a screen display of the current position of the map read from said storage means, and the self-car detected with the current position detection means, and the path to the destination searched with a path-planning

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means and always being attained the communication link with a base station.
[0011] Moreover, invention according to claim 3 is a judgment means by which the base station positional information transmitted from said base station judges whether the storage means memorizes, and a judgment means. Since the data of this new base station were memorized for the storage means and the data of the new base station which is not memorized are automatically memorized when judged with the new base station which is not memorized, it has an operation that a base station changed part calculates certainly and is obtained.
[0012] Moreover, invention according to claim 4 has an operation that give priority to the area which can be communicated, perform path planning, and a communication link is ensured.
[0013] Moreover, invention according to claim 5 carries out a screen display of this search path that performed path planning with the path planning means with a display means with a map by making into the destination the base station which can communicate, and has an operation that the path which searched as a destination the base station which can communicate when it is in the location outside [which can be communicated] area is displayed.
[0014] Hereafter, the operation gestalt of this invention is explained to a detail with reference to a drawing.
(Gestalt 1 of operation) Drawing 1 is the block diagram showing the configuration of the operation gestalt of the migration communication device of this invention. In drawing 1 , it has the bearing sensor 1 which detects bearing of a self-car, the distance robot 2 which generates the pulse according to the engine speed of the wheel of a self-car, and the signal source of supply 3 which outputs sensor signals, such as on-off signals which are not illustrated, such as a brake switch and a parking switch, and a signal for a supply voltage monitor. Furthermore, the sensor signal-processing section 4 which processes the sensor signal from the bearing sensor 1, a distance robot 2, and the signal source of supply 3 and two or more GPS (Global Positioning System) The GPS receiver 5 which receives the electric wave from a satellite and outputs self-absolute location (LAT, LONG) data, and CD-ROM drive 6 which sends out map data are formed. Moreover, it has CD-ROM7 which stored beforehand the map data which CD-ROM drive 6 reads, the display and control unit 8 which are arranged in the vehicle interior of a room, and the radio communication equipment 9 for communicating with a base station. Furthermore, the display and the control unit 8 have two or more actuation switch 8B set to liquid crystal display 8A which carries out a screen display of a map, a self-transit location, the direction, etc. from display map expansion or the directions switch of contraction, the switch that directs path planning.
[0015] Next, the main frame has the memory 12 for working (D-RAM) which memorizes the arithmetic and program control (CPU) 10 which controls each part, ROM11 which memorized beforehand the program for control which CPU10 performs, the bearing sensor 1 and a distance robot 2, the signal source of supply 3, the GPS receiver 5, CD-ROM drive 6 and the data from a radio communication equipment 9, and the operation data of CPU10. Moreover, the memory (S-RAM) 13 for backup which memorizes data required at the time of a current supply halt, and the memory (kanji font ROM) 14 which memorizes beforehand patterns which

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liquid crystal display 8A displays, such as an alphabetic character and a notation, are formed. Furthermore, it has the memory (V-RAM) 16 which memorizes the image which compounds kanji fonts, such as a name of a town from the display image and kanji font ROM14 from the image processor 15 and this image processor 15 for forming a display image based on map data or self-location data, and a road name, and is displayed by liquid crystal display 8A. Moreover, it has the communication interface 18 for the RGB conversion circuit 17 which changes into a chrominance signal the data which V-RAM16 outputs, and is outputted to liquid crystal display 8A, and the GPS receiver 5, CD-ROM drive 6 and a radio communication equipment 9 and CPU10 to exchange data.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the configuration of the migration communication device in the operation gestalt of this invention
[Drawing 2] The block diagram showing the map data format of this operation gestalt
[Drawing 3] The block diagram showing the configuration of the road layer of this operation gestalt
[Drawing 4] The block diagram showing the configuration of the path which shows the path planning approach of this operation gestalt
[Drawing 5] The block diagram of the setting rate data for link cost calculation of this operation gestalt
[Drawing 6] The mimetic diagram showing the layered structure for the path planning of this operation gestalt
[Drawing 7] The block diagram showing the table created by the path planning of this operation gestalt
[Drawing 8] The flow Fig. showing modification point creation and modification processing of the base station of this operation gestalt
[Drawing 9] The flow Fig. showing the procedure which carries out the sequential addition of the increment base station of this operation gestalt
[Drawing 10] The flow Fig. showing the processing at the time of reaching to the area of this operation gestalt which can be communicated
[Drawing 11] The indicator chart showing the display screen of guidance to the communications area of this operation gestalt
[Drawing 12] The indicator chart showing the example of the display screen at the time of a setup of the destination of this operation gestalt
[Drawing 13] The mimetic diagram showing the switch condition of the base station in the conventional land mobile radiotelephone system etc.
[Description of Notations]
1 Bearing Sensor
2 Distance Robot
3 Signal Source of Supply
4 Sensor Signal-Processing Section
5 GPS Receiver
6 CD-ROM Drive

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7 CD-ROM
8 Display and Control Unit
8A Liquid crystal display
8B Actuation switch
9 Radio Communication Equipment
10 CPU
11 ROM
12 D-RAM
13 S-RAM
14 Kanji Font ROM
15 Image Processor
18 Communication Interface

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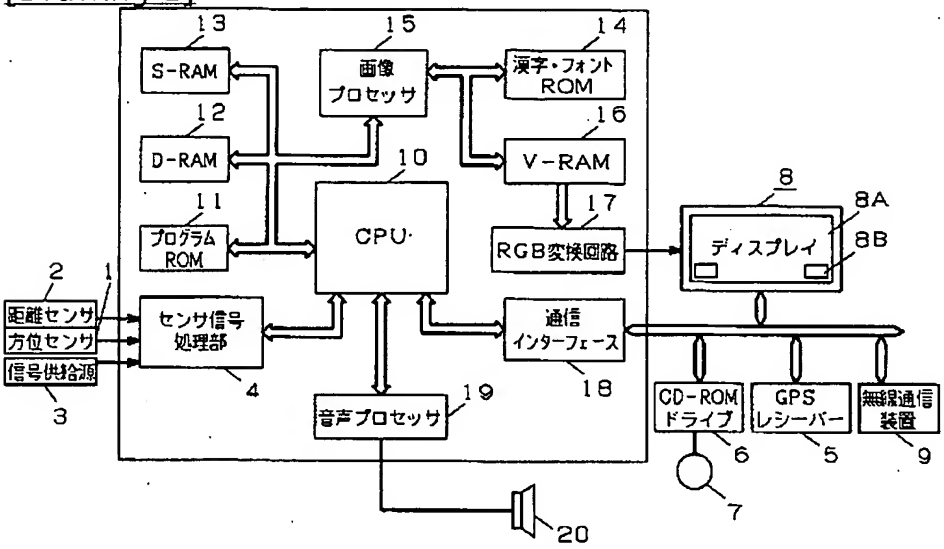
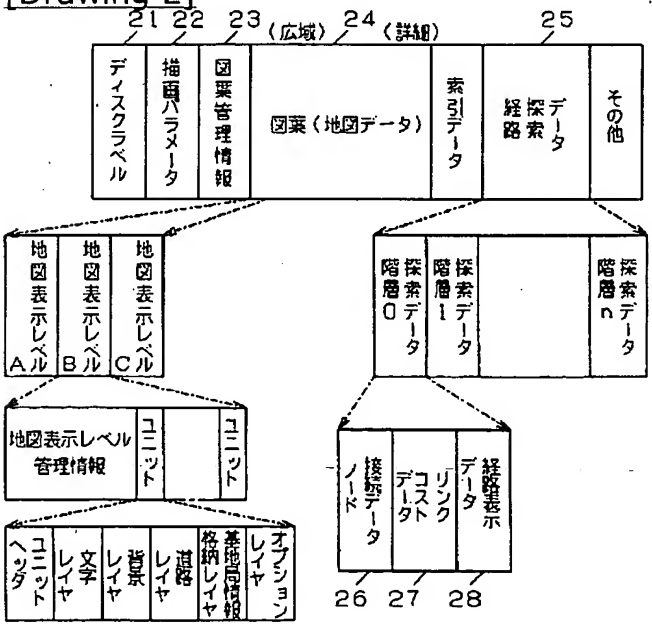
DRAWINGS

[Drawing 1]



[Drawing 2]



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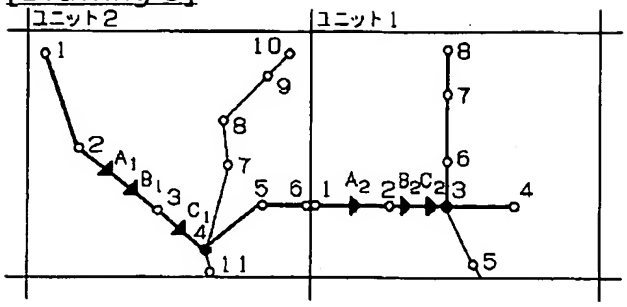
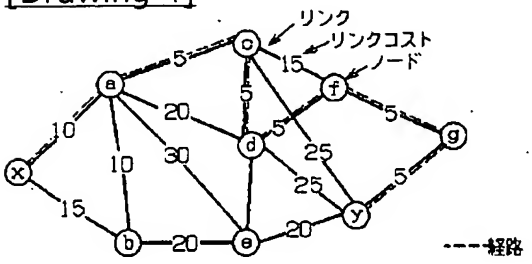
[Drawing 3]



[Drawing 4]

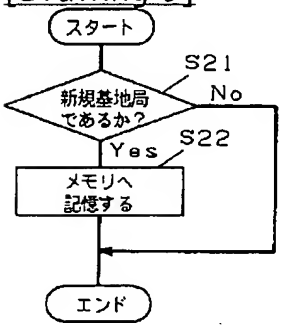


[Drawing 5]

道路種別 / 道路幅員	高速	有料道	国道	主要地方道	その他
~13.0	60	40	40	30	20
13.0~25.0	80	60	60	60	50
25.0~50.0	100	70	60	60	50
50.0~75.0	100	80	60	60	50
75.0~	100	80	60	60	50

(単位km/h)

[Drawing 9]



[Drawing 6]

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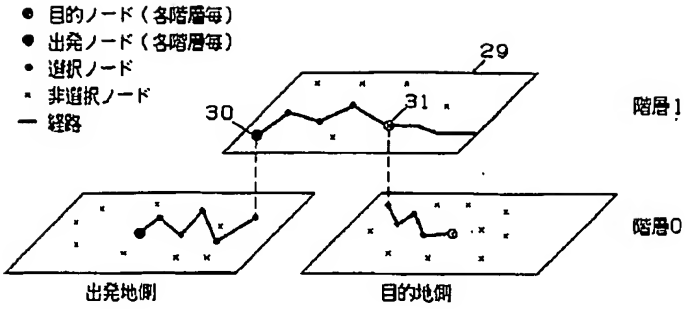
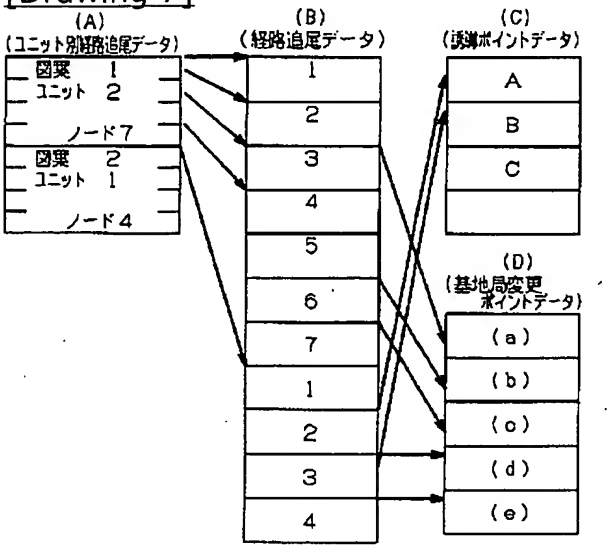
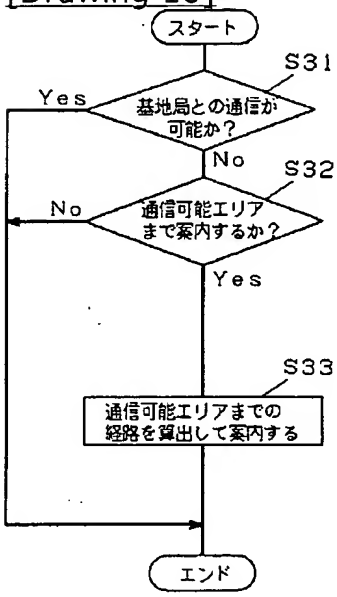


[Drawing 7]



[Drawing 10]



[Drawing 11]

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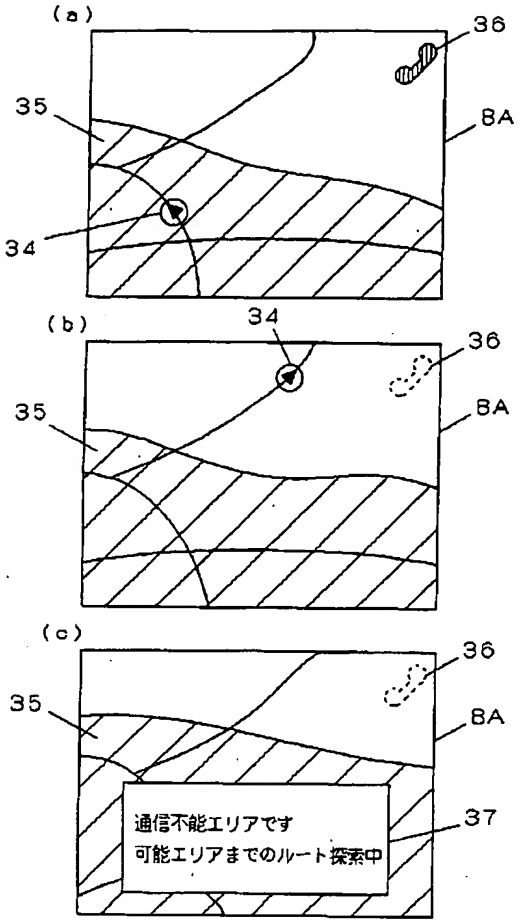
(a)
36
35
8A
34
(b)
34
36
35
8A
(c)
36
35
8A
通信不能エリアです
可能エリアまでのルート探索中
37

[Drawing 8]

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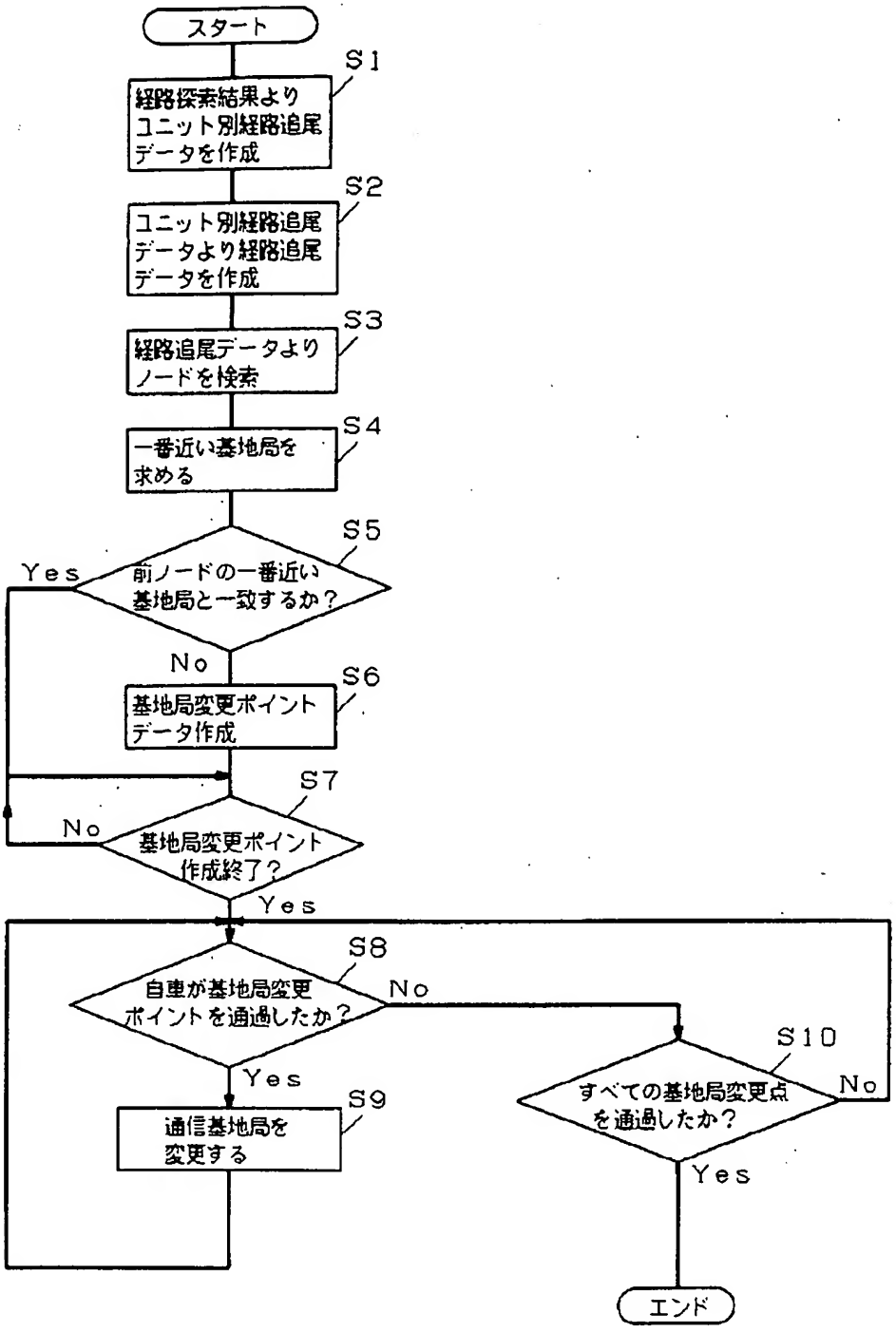
スタート
S1
経路探索結果より
ユニット別経路追尾
データを作成
S2
ユニット別経路追尾
データより経路追尾
データを作成
S3
経路追尾データより
ノードを検索
S4
一番近い基地局を
求める
S5
前ノードの一番近い
基地局と一致するか？
Yes
No
S6
基地局変更ポイント
データ作成
S7
基地局変更ポイント
作成終了？
No
Yes
S8
自車が基地局変更
ポイントを通過したか？
No
Yes
S9
通信基地局を
変更する
S10
すべての基地局変更点
を通過したか？
No
Yes
エンド

[Drawing 12]

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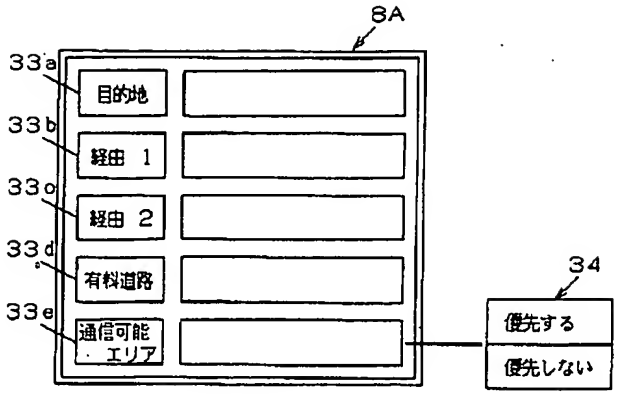
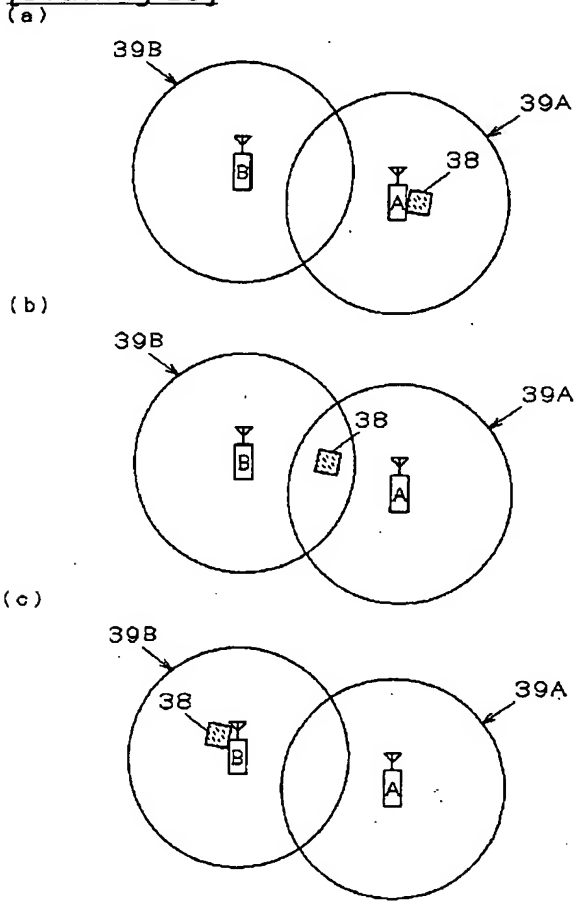


[Drawing 13]



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